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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/994,395	11/26/2001	Sergey D. Lopatin	039153-0457 (G1162)	7882

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EXAMINER
NADAV, ORI

ART UNIT	PAPER NUMBER
2811	

MAIL DATE	DELIVERY MODE
07/12/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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Office Action Summary	Application No.	Applicant(s)	
	09/994,395	LOPATIN ET AL.	
	Examiner	Art Unit	
	Ori Nadav	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 May 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4,6,8-13,15-20,22 and 23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,6,8-13,15-20,22 and 23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> **A person shall be entitled to a patent unless –**
>
> **(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.**

Claims 1-3, 6,10, 15 and 17-20 and 22 are rejected under 35 U.S.C. 102(e) as being anticipated by Edelstein et al. (6,399,496) as supported by Bogel et al. (6,749,699).

Edelstein et al. teach in figures 2 and 4 and related text a method of fabricating an integrated circuit, the method comprising:

depositing an etch stop laver 101 over a first conductive laver 46, wherein the etch stop laver is in direct contact with the first conductive laver;

depositing an insulating laver 54 after the etch stop laver is deposited over the etch stop laver;

forming a barrier layer 72 extending along lateral side walls and a bottom of a via aperture, the via aperture being configured to receive a via material that electrically connects the first conductive layer 46 and a second conductive layer 56; and

depositing/filling a copper 76 alloy via material in the via aperture to form a via, the copper alloy material including Zinc (Zn) or Silver (Ag) and at least one element for increasing grain size including Calcium (Ca) or Chromium (Cr) (column 8, lines 35-52). Although figure 2 of Edelstein et al. does not depict the processing steps of making the device, figures 4A to 4D of Edelstein et al. and related text describe the processing steps of forming a double damascene structure.

Although Edelstein et al. do not explicitly state that said at least one element increases the grain size, the claimed limitation of "at least one element for increasing grain size including Calcium (Ca) or Chromium (Cr)" is inherent in Edelstein et al.'s device, because it is known in the art that the inclusion of Calcium (Ca) or Chromium (Cr) increases the grain size.

Bogel et al. is cited as supporting evidence that the inclusion of Calcium (Ca) or Chromium (Cr) increases the grain size (figures 3-4, column 7, line 65 to column 8, line 17).

Regarding claim 22, the claimed limitation of stuffed grain boundaries is inherent in Edelstein et al.'s device, because Edelstein et al.'s structure is identical to the claimed structure.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 8, 13 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Edelstein et al. in view of Bogel et al.

Edelstein et al. teach substantially the entire claimed structure, as applied to claims 1, 6 and 10-11 above, except Calcium (Ca) or Chromium (Cr) having one atomic percent or less.

Bogel et al. teach that Calcium (Ca) or Chromium (Cr) having one atomic percent or less (column 7, lines 65-67).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use Calcium (Ca) or Chromium (Cr) having one atomic percent or less in prior art's device in order to provide a stable Cu alloy with improved electromigration properties.

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Edelstein et al. and Bogel et al., as applied to claims 1 and 17 above, and further in view of Merchant et al. (6,440,849).

Regarding claim 4, Edelstein et al. and Bogel et al. teach substantially the entire claimed structure, as applied to claim 1 above, except the copper alloy via material includes one atomic percent or less of Zinc (Zn) or Silver (Ag).

Merchant et al. teach the copper alloy via material includes one atomic percent or less of Zinc (Zn) or Silver (Ag) (column 3, lines 6-12).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use the copper alloy via material includes one atomic percent or less of Zinc (Zn) or Silver (Ag) in prior art's device in order to provide a stable Cu alloy with improved electromigration properties.

Claims 9 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Edelstein et al. and Bogel et al., as applied to claims 1, 6 and 17 above, and further in view of Gross (6,380,083).

Edelstein et al. and Bogel et al. teach substantially the entire claimed structure, as applied to claims 1, 6 and 17 above, except the increased grain size is between 0.5 and 3 microns.

Gross teaches an increased grain size is between 0.5 and 3 microns (column 5, lines 30-36).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use an increased grain size is between 0.5 and 3 microns in prior art's device in order to provide a stable Cu alloy with improved electromigration properties.

Claims 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Edelstein et al. and Bogel et al., as applied to claim 10 above, and further in view of Andricacos et al. (6,090,710).

Edelstein et al. and Bogel et al. teach substantially the entire claimed structure, as applied to claim 10 above, except the ternary copper alloy via material is at least 98 atomic percent copper and includes Zinc (Zn), Silver (Ag), or Tin (Sn).

Andricacos et al. teach a ternary copper alloy via material is at least 98 atomic percent copper and includes Zinc (Zn), Silver (Ag), or Tin (Sn) (column 8, lines 15-16 and table 1).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a ternary copper alloy via material is at least 98 atomic percent copper and includes Zinc (Zn), Silver (Ag), or Tin (Sn) in prior art's device in order to obtain low resistance copper alloy for vias.

Response to Arguments

Applicant argues that Edelstein et al. do not teach the claimed limitation of "at least one element for increasing grain size including Calcium (Ca) or Chromium (Cr)", because Bogel et al., which was cited as supporting evidence that the inclusion of Calcium (Ca) or Chromium (Cr) increases the grain size, merely states that "FIG. 3 graphically illustrates the effect of solution annealing (SA) time and temperature on the recrystallization and grain growth for a copper alloy having 0.40% chromium".

Although Edelstein et al. do not explicitly state that said at least one element increases the grain size, the claimed limitation of "at least one element for increasing grain size including Calcium (Ca) or Chromium (Cr)" is inherent in Edelstein et al.'s device, because it is known in the art that the inclusion of Calcium (Ca) or Chromium (Cr) increases the grain size. Bogel et al. is merely cited as supporting evidence that the inclusion of Calcium (Ca) or Chromium (Cr) increases the grain size (column 7, lines 65-67).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ori Nadav whose telephone number is 571-272-1660. The examiner can normally be reached between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Elms can be reached on 571-272-1869. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

O.N.
7/7/07

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